REMARKS

Claims 1-9, 11-25, and 27-32 are pending in the application. Claims 5, 10, 17, 22, 23, 26, and 29 are cancelled without prejudice or a disclaimer. Claim 6 is withdrawn from consideration. Claims 33-38 are added. Claims 1 and 24, and newly added claims 38 and 39 are independent claims.

New Claims

Claims 33-39 are added.

Support for claim 33-34 can be found in FIG. 1.

Support for claim 35 can be found in paragraph [0026], line 1-4.

Support for claim 36 can be found in paragraph [0026], line 11-15.

Support for claim 37 can be found in paragraph [0028], line 18-19.

Support for claim 38 can be found in FIG. 1 and in previously presented claim 1.

Support for claim 39 can be found in FIG. 1 and in Detailed Description, at paragraph [0026] and at paragraph [0028], line 8-15.

As such, no new matter has been introduced. In addition, Applicants believe that each of claims 33-39 contains patentable subject matter. Accordingly, Applicants respectfully request entry and early passage of claims 33-39.

Claim Objection

Claims 5 and 29 stand objected to for allegedly failing to further limit the subject matter of the previous claim.

In order to expedite prosecution, Applicants cancel claims 5 and 29 without prejudice or a disclaimer. Applicants respectfully request withdrawal of the objection.

35U.S.C. 112 Rejection

Claims 1-4, 7-9, and 11-21 stand rejected under 35 U.S.C. 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

In rejecting claims 1-4, 7-9, and 11-21, the Patent Office indicates that "the [Applicants have] failed to further limit the claimed apparatus since a structural limitation with respect to the apparatus further comprising a bias structure for biasing the target with a negative voltage has not been claimed."

As noted in section 2173.04 of the Manual of Patent Examining Procedure (the "MPEP"), a **broad claim is not an indefinite claim**. "If the scope of the subject matter embraced by the claims is clear, and if applicants have not otherwise indicated that they intend the invention to be of a scope different from that defined in the claims, then the claims comply with 35 U.S.C. 112, second paragraph" (id.).

Applicants respectfully submit that, first, each of the claims and the scope thereof is clear to a person of ordinary skill in the art of, for example, material or semiconductor processing. Second, Applicants have not indicated, nor has the Patent Office established, that Applicants intend the subject matter of the present application to be of a scope different from that recited in the claims (see MPEP 2173.04).

Accordingly, claims 1-4, 7-9, and 11-21 are broad, clear claims that comply with the requirements of 35 U.S.C. 112, second paragraph. Applicants respectfully request withdrawal of the rejection.

35U.S.C. §103(a) Rejection

Claim 1 stands rejected under 35 U.S.C. §103(a) as allegedly being obvious over Kadomura (U.S. 5,567,268) ("Kadomura I") in view of the alleged Admitted Prior Art (the "APA") or Trow (U.S. 5,824,607) and one of Okumura *et al.* (U.S. 5,888,413) ("Okumura"), Chen *et al.* (U.S. 6,527,912) ("Chen"), and Becker *et al.* (U.S. 6,899,817) ("Becker").

Claim 1 also stands rejected under 35 U.S.C. §103(a) as allegedly being obvious over Kadomura (U.S. 6,096,160) ("Kadomura II") in view of the APA or Trow and Okumura, Chen, and Becker.

Claim 1 recites "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**..., wherein **each antenna** of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**..."

Claim 1 is amended to further clarify the claim. Support for the amendments can be found in previously presented claim 1, FIG. 1, and in the Detailed Description portion of the specification, at paragraph [0026], line 7-23, and at paragraph [0028], line 8-12.

As described in paragraph [0026], status of an antenna as an active or parasitic may depend on, among others, the antenna's electrical coupling with the RF source 26 (see line 19-23). For example, an antenna may be an active antenna if the antenna is electrically coupled to an RF source that is configured to generate RF current (see FIG. 1 and paragraph [0026] line 1-2 and line 19-23 (indicating that an active antenna may become a parasitic antenna if the antenna's electrical coupling with the RF source 26, among others, changes from electrical coupling to a non-electrical coupling)). Meanwhile, an antenna may be a parasitic antenna if the antenna is electrically decoupled from the RF source (see id. (indicating that a parasitic antenna may become an active antenna if the antenna's

electrical coupling with the RF source 26, among others, changes from that of a non-electrical coupling to an electrical coupling)).

In addition, the specification discloses that antenna 40 and antenna 44, where one is active and the other is parasitic, are RF antenna 28 or RF antenna unit 28 (see FIG. 1 and paragraph [0028], line 8-12). Such RF antenna 28 or the RF antenna unit 28 resonates RF current and induces electro-magnetic field that excites and ionizes the process gas to generate plasma within the plasma chamber (previously presented claim 1 and paragraph [0028], line 8-12).

Accordingly, the amendments to claim 1 are fully supported by the present application, and claim 1 complies with the 35 U.S.C. 112, written description requirement. No new matter is introduced. Applicants respectfully submit that claim 1, as amended, is patentable over the references, alone or in combination.

As noted in MPEP 2143(A), a rejection of a claim as allegedly being obvious cannot be sustained unless the Patent Office establishes that one or more references **teach all features** recited in the claim, "with the only difference between the [feature] and [one or more references] being lack of actual combination of the [feature] in a single [] reference" (see MPEP 2143(A)).

In rejecting claim 1, the Patent Office indicates that Kadomura I discloses a plasma apparatus comprising a loop antenna 22 and a multi-turn antenna 31 (the present Office Action, page 4, line 1-8). According to the Patent Office, one of the loop antenna 22 and the multi-turn antenna 31 is one of an active antenna and a parasitic antenna of claim 1, and the other one of the loop antenna 22 and the multi-turn antenna 31 is the other one of the active antenna and the parasitic antenna of claim 1 (id.). The Patent Office also indicates that Kadomura II discloses a plasma apparatus comprising a loop antenna 52 and a solenoid coil 53 (the present Office Action, page 15, line 17-21). According to the Patent Office, the loop antenna 52 of Kadomura II is the active antenna of claim 1 and the

solenoid coil 53 is the parasitic antenna of claim 1 (id.).

Kadomura I, as read by Applicants, discloses a plasma processing apparatus comprising a loop antenna 22, which is configured to generate helicon wave plasma (column 5, line 53-65), and a multi-turn antenna 31, which generates inductively coupled plasma ("ICP") (column 6, line 52-65). According to Kadomura I, the loop antenna 22 is coupled to an RF power supply 39 via a first switch 35 and the multi-turn antenna 31 is coupled to the RF power supply 39 via a second switch 38 (FIG. 2-3). Kadomura I indicates that **if the second switch 38 is turned OFF** such that the multi-turn antenna 31 is not electrically coupled to the RF power supply 39, **the multi-turn antenna 31 does not generate plasma** in the plasma chamber (Kadomura I, column 7, line 31-36). Meanwhile, **if the first switch 35 is turned OFF** such that the loop antenna 22 is not electrically coupled to the RF power supply 39, **the loop antenna 22 does not generate plasma** in the plasma chamber (id., at line 37-41).

Accordingly, Kadomura I discloses an apparatus comprising a loop antenna 22 and a multi-turn antenna 31, where each of the loop antenna 22 and the multi-turn antenna 31, if not electrically coupled to the RF power supply 39, does not generate plasma in the plasma chamber. Kadomura I, therefore, discloses an antenna unit that differs from the RF antenna unit of claim 1. Kadomura does not disclose "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**..., wherein **each antenna** of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**...," as recited in claim 1.

Kadomura II, as read by Applicants, discloses an apparatus comprising a loop antenna 52 that is electrically coupled to an RF source 66 and a pair of solenoid coils 53a and 53b that are electrically coupled to a DC source 68 (FIG. 5 and 6). According to Kadomura II, the loop antenna

52 is continuously coupled to the RF source 66 and continuously supplied with RF current (column 11, line 2-4). Meanwhile, the solenoid coils 53a and 53b are electrically coupled to the DC source 68 by a switch 67, which can be turned ON or OFF and which may electrically couple or decouple the solenoid coils 53a and 53b to and from the DC source 67 (column 10, line 63 – column 11, line 2).

Applicants respectfully submit that the loop antenna 52 is continuously coupled to and powered by the RF source 66. Meanwhile, the solenoid coils 53a and 53b, when powered, are each electrically coupled to the DC source, and each **does not resonate RF current** to generate plasma within the plasma chamber. Accordingly, the loop antenna 52 and the solenoid coil 53, alone or in combination, are different from the RF antenna unit of claim 1. Kadomura II, therefore, does not disclose or teach "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**..., wherein **each antenna** of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**...," as recited in claim 1.

In the Related Art section of the present application, various apparatuses such as, among others, chemical vapor deposition (CVD), plasma doping (PLAD) apparatus, and other traditional plasma based processing apparatuses are disclosed (see Related Art portion (disclosing CVD apparatus, PLAD apparatus, and other plasma based apparatuses described in U.S. Pat. No. 4,948,458, U.S. Pat. No. 5346,578, U.S. Pat. No. 5,540,800, U.S. Pat. No. 6,514,838, and U.S. Pat. No. 6,237,527)). However, nowhere in the Related Art section of the present application or the patents cited thereon is there a disclosure of "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**...,

wherein **each antenna** of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**..." as recited in claim 1.

Trow, as read by the Applicants, discloses an inductively coupled plasma reactor. According to Trow, the plasma reactor comprises "an inductive antenna coil 30 which is powered by an RF supply and matching network 31" (Trow, column 4, line 4-8). As such, Trow discloses an antenna coil 30 that differs from the RF antenna unit of claim 1. Trow does not disclose or teach "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**..., wherein **each antenna** of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**...," as recited in claim 1.

Okumura, as read by Applicants, discloses a plasma processing apparatus. According to Okumura, the apparatus comprises a coil 1 that is powered by high frequency power source 6 (Okumura, FIG. 1 and column 5, line 13-16). As such, Okumura discloses a coil 1 that differs from the RF antenna unit of claim 1. Okumura does not teach or disclose "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**..., wherein **each antenna** of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**...," as recited in claim 1.

Chen, as read by Applicants, discloses an apparatus comprising a coil 24 (Chen, FIG. 2 and column 7, line 65-67). According to Chen, the coil 24 comprises a segment having multiple turns 101-103 ("the multiple turn segment 101-103") (id.) and a segment 115 ("the stacked segment 115") stacked on the multiple turn segment 101-103 (column 7, line 28-30; FIG. 6). According to Chen,

the multiple turn segment 101-103 is electrically coupled to the RF source 26 via an impedance matching network 28 at terminal 111 disposed on the first turn 101 of the segment having multiple turns 101-103 (FIG. 1; see also column 5, line 49-51 and column 7, line 12-15). The stacked segment 115, meanwhile, is electrically coupled to the terminal 113 disposed on the third turn 103 via strap 117, and thus electrically coupled to the RF source 26 (FIG. 1; see also column 7, line 58 – column 8, line 5).

As such, Chen discloses that the coil 24, comprising the multiple turn segment 101-103 and the stacked segment 115, is electrically coupled to the RF source 26, the coil 24 that differs from the RF antenna unit of claim 1. Chen does not disclose or teach "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**..., wherein **each antenna** of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**...," as recited in claim 1.

Becker, as read by Applicants, discloses an apparatus comprising an ICP source 13 powered by an ICP coil generator 17, the ICP coil generator 17 that produces RF current (Chen, column 7, 47-51), and a magnetic field coil 21 that is directly coupled and powered by, for example, a direct current (DC) supply unit 23 (id., at column 6, line 33-40). Applicants respectfully submit that neither the ICP coil generator 17 nor the magnetic field coil 21 is a parasitic antenna that is not electrically coupled to the RF source, that resonates RF current, and that excites and ionizes the process gas to generate a plasma within the plasma chamber. As such, Becker discloses an ICP coil generator 17 and a magnetic field coil 21 that differs from the RF antenna unit of claim 1. Becker does not teach or disclose "an RF antenna unit including an active antenna and **a parasitic antenna**, the parasitic antenna [that] **is not electrically coupled to the RF source**..., wherein **each antenna**

of the RF antenna unit **resonates RF current** and induces electro-magnetic field... **that excites and ionizes the process gas to generate a plasma within the plasma chamber**...," as recited in claim 1.

Accordingly, each of Kadomura I, Kadomura II, APA, Trow, Okumura, Chen, and Becker does not disclose or teach the RF antenna unit of claim 1 and does not disclose all features of claim 1. As each of Kadomura I, Kadomura II, APA, Trow, Okumura, Chen, and Becker fails to teach all features recited in claim 1, the combination of Kadomura I, APA, Trow, Okumura, Chen, and Becker also fails to teach all features recited in claim 1, and the combination fails to render claim 1 obvious. Applicants respectfully request withdrawal of the rejection.

Claim 24 stands rejected under 35 U.S.C. §103(a) as allegedly being obvious over Kadomura I in view of the APA, Trow, Okumura, Chen, Becker, and Collins *et al.* (U.S. 5,556,501) ("Collins").

Claim 24 recites a plasma chamber comprising "a vertical cylindrical dielectric section **contacting and extending** from the horizontal planar dielectric section;... a radio frequency antenna unit including **a horizontally-extending coil disposed on the horizontal planar dielectric section** and a **vertically-extending coil disposed on the vertical cylindrical dielectric section**..."

Claim 24 is amended to further clarify the claim. Support for the amendment can be found in FIG. 1 and in the previously presented claim 24.

Applicants respectfully submit that, as noted above, a rejection under obviousness cannot be sustained unless the Patent Office establishes that one or more references **teach all features** recited in the claim, "with the only difference between the [feature] and [one or more references] being lack of actual combination of the [feature] in a single [] reference" (see MPEP 2143(A)). In addition, "**[a]ll words in a claim must be considered** in judging the patentability of that claim against the prior art" (MPEP 2143.03 (citing *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA

1970))).

In rejecting claim 24, the Patent Office indicates that Kadomura I discloses a plasma chamber comprising "a horizontal planar section and a vertical cylindrical dielectric section 21 that extends from the horizontal planar section" (the present Office Action, page 11, line 5-7). In addition, the Patent Office indicates that Kadomura I contains a horizontally-extending coil 22 positioned proximate to the horizontal planar dielectric section and a vertically-extending coil 31 positioned proximate to the vertical cylindrical dielectric section. The Patent Office, in the process, equates the loop antenna 22 and the multi-turn antenna 31 of Kadomura I to the horizontally-extending coil and vertically-extending coil of claim 24, respectively.

The plasma chamber disclosed in Kadomura I includes a loop antenna 22 that is circumferentially around a non-conductive bell jar 21 (FIG. 2 and 3; column 5, line 54-58) and a multi-turn antenna 31 disposed on a non-conductive cylinder 26 (FIG. 2 and 3; column 6, line 57-61).

The loop antenna 22 disclosed in Kadomura I, however, is not a coil, much less a horizontally-extending coil or a vertically-extending coil (see FIG. 2 and 3). By disclosing the multi-turn antenna 31 and the loop antenna 22, the loop antenna 22 that is neither a horizontally-extending nor a vertically-extending coil, Kadomura I does not disclose or teach a radio frequency antenna unit including a horizontally-extending coil and a vertically-extending coil.

In addition, the plasma chamber of Kadomura I does not include a vertical cylindrical dielectric section **contacting and extending** from a horizontal planar dielectric section, the vertical cylindrical dielectric section on which a vertically-extending coil is disposed and the horizontal cylindrical dielectric section on which a horizontally-extending coil is disposed. Kadomura I explicitly teaches that the non-conductive bell jar 21, on which the loop antenna 21 is disposed, and

the non-conductive cylinder 26, on which the multi-turn antenna 31 is disposed, are separated and **spaced apart from one another** (FIG. 2 and 3) by a conductive top board 24 (column 6, line 39-41).

Accordingly, Kadomura I cannot possibly teach or disclose "a vertical cylindrical dielectric section **contacting and extending** from the horizontal planar dielectric section;... a radio frequency antenna unit including **a horizontally-extending coil disposed on the horizontal planar dielectric section** and a **vertically-extending coil disposed on the vertical cylindrical dielectric section**...," as recited in claim 24.

As noted above, in the Related Art section of the present application, Trow, Okumura, Chen, and Becker disclose CVD, PLAD, and other plasma based apparatuses. However, in the Related Art section, Trow, Okumura, Chen, and Becker do not disclose "a vertical cylindrical dielectric section **contacting and extending** from the horizontal planar dielectric section;... a radio frequency antenna unit including **a horizontally-extending coil disposed on the horizontal planar dielectric section** and a **vertically-extending coil disposed on the vertical cylindrical dielectric section**...," as recited in claim 24.

Collins discloses a silicon scavenger in an inductively coupled RF plasma reactor. As illustrated in FIG. 1-3, the reactor comprises a cylindrical wall 17W of dielectric such as quartz and a cover or top 17T typically aluminum or anonized aluminum (Collins, column 7, line 33-39). In addition, the reactor comprises an antenna 30, preferably having a multiple turn cylindrical configuration, coupled to an RF supply via a matching network 31. However, nowhere in Collins is there a disclosure of a plasma chamber comprising vertical cylindrical dielectric section and horizontal planar dielectric section, the vertical cylindrical dielectric section on which the vertically-extending coil is disposed, the horizontal planar dielectric section on which horizontally-extending coil is disposed. As such, Collins does not disclose or teach "a vertical cylindrical dielectric section

contacting and extending from the horizontal planar dielectric section;... a radio frequency antenna unit including **a horizontally-extending coil disposed on the horizontal planar dielectric section** and a **vertically-extending coil disposed on the vertical cylindrical dielectric section**...," as recited in claim 24.

Accordingly, Kadomura I, the APA, Trow, Okumura, Chen, Becker, and Collins, alone or in combination, fail to disclose or teach all features of claim 24. Applicants respectfully request withdrawal of the rejection.

Other claims in consideration are each dependent on the independent claims 1, 24, 38, and 39, and believed to be patentable for the same reasons. Since each dependent claim is also deemed to define other aspects of the invention, individual consideration of the patentability of each on its own merit is respectfully requested.

Should the Examiner deem that there is any issue which may be best resolved by telephone, the Examiner is respectfully requested to contact the representative undersigned below. Please charge any additional fees or credit any overpayments to deposit account No. 50-0896.

Respectfully submitted,
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